Notice of Allowability	Application No.	Applicant(s)	
	09/990,561	WESTFALL ET AL.	
	Examiner	Art Unit	
	Joshua Joo	2154	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *6/7/05*.

2. ☒ The allowed claim(s) is/are *1-4,6-24 and 26-37*.

3. ☒ The drawings filed on *21 November 2001* are accepted by the Examiner.

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☒ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

JOHN FOLLANSBEE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2100

Examiner's Amendment

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

2. Authorization for this examiner's amendment was given in a telephone interview and a FAX submitted by Kevin G. Shao on June 7, 2005.

3. The application has been amended as follows:

1. (Currently Amended) A method comprising:

identifying network elements at endpoints of a data connection channel ;

generating a candidate path between the network elements at the endpoints;

validating the candidate path by determining whether the candidate path provides at least a service requirement based on a service description describing at least one of:

minimum bandwidth that is to be guaranteed for each data connection,

maximum bandwidth to which each data connection is constrained,

maximum delay that packets in a data connect are allowed to tolerate,

maximum jitter that a data connection is allowed to tolerate,

minimum reliability that each data connection is to be provided,

inclusion of network elements capable of acting as security gateways that bracket untrusted sections of the candidate path,

reachability, and

data collection capability to be instantiated between network locations when the service is in use[[;]] , ~~and~~

configuring network elements along a validated candidate path to implement the service requirement[[.]]; and

identifying a change in a routing table entry;

identifying data connection channels provisioned on a data link connected to an interface referenced by the routing table entry prior to the change;

for each data connection channel provisioned on the data link, identifying whether the data connection channel is affected by the change;

for each data connection affected by the change, de-provisioning the data connection channel affected by the change;

for each data connection channel affected by the change, re-provisioning the data connection channel affected by the change;

reserving a predetermined percentage of bandwidth for each direction of a data link, wherein reserving the predetermined percentage of bandwidth is to

provide room for manually deployed services,

provide a buffer to accommodate unanticipated network traffic, and

provide a buffer to accommodate one of an imprecisely understood behavior and an imprecise bandwidth control in a router feeding of a data link; and

determining an effective bandwidth capacity of the data link by subtracting the reserve bandwidth from an available bandwidth associated with the data link.

5. (Canceled).

6. (Currently Amended) The method of claim 1, wherein generating a candidate path between the network elements at the endpoints further comprises:

assigning to a link in a graph representing the network that is not in a preferred area of a network a weight that is different than a weight assigned to a link in the graph that is in a preferred area of the network; and

adjusting a weight assigned to a link in the graph depending on a proportion of usage of available bandwidth of the link, wherein a link in the graph having heavier usage relative to other links in the graph is adjusted to a weight indicating a less preference, and wherein a link in the graph is adjusted to a weight indicating a lesser preference, and wherein a link in the graph having lighter usage relative to other links in the graph is adjusted to a weight indicating a greater preference.

10. (Currently amended) A method for a provisioning system comprising:

identifying a candidate path for a newly requested service, the newly requested service having a service description, wherein the newly requested service is in an Internet Protocol (IP) network, the IP network having a plurality of routers, wherein the identified candidate path travels through a set of the plurality of routers;

determining whether the set of the plurality of routers can be configured to meet a set of requirements specified by the service description,

generating a graph representing the network, wherein vertices represent routers and links represent data links,

wherein each data link in the candidate path includes an available bandwidth equal or greater than the minimum bandwidth of ~~the~~ a corresponding data connection channel,

wherein if any data link in the candidate path does not have an available bandwidth equal or greater than the minimum bandwidth of the corresponding data connection channel, the corresponding available bandwidth equal or greater than the minimum bandwidth of the corresponding data connection channel is removed from the graph representing the network for further consideration,

wherein the minimum bandwidth of the corresponding data connection channel is determined based on a product of the minimum bandwidth described in a corresponding data connection description and the maximum amount of concurrent service usage from the service description, and

wherein the maximum bandwidth of the corresponding data communication channel is determined based on a product of the maximum bandwidth from the corresponding data connection description and the maximum amount of concurrent service usage from the service description; and

if the set of plurality of routers are determined to meet the set of requirements, then translating the set of requirements into a corresponding set of router management commands to configure each router in the set of the plurality of routers.

17. (Currently Amended) The method of claim 15, further comprising:

assigning to a link in a graph representing the network that is not in a preferred area of a network a weight that is different than a weight assigned to a link in the graph that is in a preferred area of the network;

adjusting a weight assigned to a link in the graph depending on a proportion of usage of available bandwidth of the link, wherein a link in the graph having heavier usage relative to other links in the graph is adjusted to a weight indicating a lesser preference, and wherein a link in the

graph having lighter usage relative to other links in the graph is adjusted to a weight indicating a greater preference; and

displaying the graph in a display, wherein vertices represent routers and links represent data links, wherein links in the graph have a directionality indicating a direction in which packets in one embodiment flow on the corresponding data link and wherein two-way data links are represented in the graph by one of a bi-directional link and two back-to-back uni-directional links directed in opposite directions.

20. (Currently Amended) The provisioning system of claim 18, wherein the provisioning engine is further to:

assigning to a link in a graph representing the network that is not in a preferred area of a network a weight that is different than a weight assigned to a link in the graph that is in a preferred area of the network;

adjusting a weight assigned to a link in the graph depending on a proportion of usage of available bandwidth of the link, wherein a link in the graph having heavier usage relative to other links in the graph is adjusted to a weight indicating a lesser preference, and wherein a link in the graph having lighter usage relative to other links in the graph is adjusted to a weight indicating a greater preference; and

displaying the graph in a display, wherein vertices represent routers and links represent data links, wherein links in the graph have a directionality indicating a direction in which packets in one embodiment flow on the corresponding data link and wherein two-way data links are represented in the graph by one of a bi-directional link and two back-to-back uni-directional links directed in opposite directions.

21. (Currently Amended) A machine-readable recording medium storing the ~~that provides~~ instructions that, when executed by a machine, cause the machine to perform operations comprising:

identifying network elements at endpoints of a data connection channel;

generating a candidate path between the network elements at the endpoints;

validating the candidate path by determining whether the candidate path provides at least a service requirement based on a service description describing at least one of:

minimum bandwidth that is to be guaranteed for each data connection,

maximum bandwidth to which each data connection is constrained,

maximum delay that packets in a data connect are allowed to tolerate,

maximum jitter that a data connection is allowed to tolerate,

minimum reliability that each data connection is to be provided,

inclusion of network elements capable of acting as security gateways that bracket untrusted sections of the candidate path,

reachability, and

data collection capability to be instantiated between network locations when the service is in use[[;]] , ~~and~~

configuring network elements along a validated candidate path to implement the service requirement[[.]]; and

identifying a change in a routing table entry;

identifying data connection channels provisioned on a data link connected to an interface referenced by the routing table entry prior to the change;

for each data connection channel provisioned on the data link, identifying whether the data connection channel is affected by the change;

for each data connection affected by the change, de-provisioning the data connection channel affected by the change;

for each data connection channel affected by the change, re-provisioning the data connection channel affected by the change;

reserving a predetermined percentage of bandwidth for each direction of a data link, wherein reserving the predetermined percentage of bandwidth is to

provide room for manually deployed services,

provide a buffer to accommodate unanticipated network traffic, and

provide a buffer to accommodate one of an imprecisely understood behavior and an imprecise bandwidth control in a router feeding of a data link; and

determining an effective bandwidth capacity of the data link by subtracting the reserve bandwidth from an available bandwidth associated with the data link.

22. (Currently Amended) The machine-readable recording medium storing the instructions of claim 21, wherein the service description further describes at least one of:

subscribers who subscribe the service;

parties involved in providing or using the service;

network locations of each party;

a maximum amount of concurrent usage of the service between the network locations;

each data connection to be instantiated between the network locations when the service is in use;

whether security is to be provided and a security profile which determines nature of the security to be provided; and

types of data to be collected regarding packets flowing through the data connection and granularity at which the data is to be collected.

23. (Currently Amended) The machine-readable recording medium storing the instructions of claim 21, wherein operations further comprise recording a configuration performed on the network elements in a provisioning database, wherein the provisioning database stores information selected from a group consisting of:

a service description;

a data connection description for describing one of one-way and two-way data connection channels being provisioned;

security profiles of all services previously provisioned;

a path taken through a network by each data connection channel; and

a configuration that has been performed at each router along the path taken by each data connection channel.

24. (Currently Amended) The machine-readable recording medium storing the instructions of claim 23, wherein the configuration of the network elements are performed further based on network topologies of the network provided via a network topology database, wherein the network topology database stores information selected from a group consisting of:

a vendor and model of each router that determines what protocols to use to communicate with the router;

an IP subnet to which each router interface belongs;

an available bandwidth in each direction of each data link;

a status of each data link and the interfaces connected;

a type of packet forwarding mechanism used on each interface;

a copy of the routing table from each router;

a copy of any information from each router that indicates which QoS-enhanced forwarding mechanisms are directing packets;

to whom each IP subnet, and hence each router interface, is dedicated to; and

whether a router can function as a security gateway.

25. (Canceled).

26. (Currently Amended) The machine-readable recording medium storing the instructions of 21, wherein operations further comprise:

assigning to a link in a graph representing the network that is not in a preferred area of a network a weight that is different than a weight assigned to a link in the graph that is in a preferred area of the network; and

adjusting a weight assigned to a link in the graph depending on a proportion of usage of available bandwidth of the link, wherein a link in the graph having heavier usage relative to other links in the graph is adjusted to a weight indicating a less preference, and wherein a link in the graph is adjusted to a weight indicating a lesser preference, and wherein a link in the graph having lighter usage relative to other links in the graph is adjusted to a weight indicating a greater preference.

27. (Currently Amended) The machine-readable recording medium storing the instructions of claim 26, wherein the operations further comprise displaying the graph in a display, wherein vertices represent routers and links represent data links, wherein links in the

graph have a directionality indicating a direction in which packets in one embodiment flow on the corresponding data link and wherein two-way data links are represented in the graph by one of a bi-directional link and two back-to-back uni-directional links directed in opposite directions.

28. (Currently Amended) The machine-readable recording medium storing the instructions of claim 27, further comprising determining the minimum bandwidth of the candidate path that is required by the service being deployed,

wherein each data link in the candidate path includes an available bandwidth equal or greater than the minimum bandwidth of the corresponding data connection channel,

wherein if any data link in the candidate path does not have an available bandwidth equal or greater than minimum bandwidth of the corresponding data connection channel, the corresponding available bandwidth equal or greater than the minimum bandwidth of the corresponding data connection channel is removed from the graph for further consideration,

wherein the minimum bandwidth of the data connection channel is determined based on a product of the minimum bandwidth described in a corresponding data connection description and the maximum amount of concurrent service usage from the service description, and

wherein the maximum bandwidth of the data connection channel is determined based on a product of the maximum bandwidth from the corresponding data connection description and the maximum amount of concurrent service usage from the service description.

29. (Currently Amended) The machine-readable recording medium storing the instructions of claim 28, wherein if a router is not capable of managing cross-router queuing delay, the minimum bandwidth is determined based on the following:

$BW_{min} = \max(BW_{max}, (S_{max} / D_{max}))$,

wherein BW_{min} represents a minimum bandwidth in bits per second, wherein BW_{max} represents a required maximum bandwidth from the data connection description in bits per second, wherein S_{max} represents a maximum size of a packet in bits, and wherein D_{max} represents a maximum cross router queuing delay in seconds.

30. (Currently Amended) A machine-readable recording medium storing the ~~that provides~~ instructions that when executed by a machine, cause the machine to perform operations comprising:

identifying a candidate path for a newly requested service, the newly requested service having a service description, wherein the newly requested service is in an Internet Protocol (IP) network, the IP network having a plurality of routers, wherein the identified candidate path travels through a set of the plurality of routers;

determining whether the set of the plurality of routers can be configured to meet a set of requirements specified by the service description,

generating a graph representing the network, wherein vertices represent routers and links represent data links,

wherein each data link in the candidate path includes an available bandwidth equal or greater than the minimum bandwidth of ~~the~~ a corresponding data connection channel,

wherein if any data link in the candidate path does not have an available bandwidth equal or greater than the minimum bandwidth of the corresponding data connection channel, the corresponding available bandwidth equal or greater than the minimum bandwidth of the corresponding data connection channel is removed from the graph representing the network for further consideration,

wherein the minimum bandwidth of the corresponding data connection channel is determined based on a product of the minimum bandwidth described in a corresponding data connection description and the maximum amount of concurrent service usage from the service description, and

wherein the maximum bandwidth of the corresponding data communication channel is determined based on a product of the maximum bandwidth from the corresponding data connection description and the maximum amount of concurrent service usage from the service description; and

if the set of plurality of routers are determined to meet the set of requirements, then translating the set of requirements into a corresponding set of router management commands to configure each router in the set of the plurality of routers.

31. (Currently Amended) The machine-readable recording medium storing the instructions of claim 30, wherein the service description comprises:

a minimum bandwidth that is to be guaranteed for each data connection,

a maximum bandwidth to which each data connection is constrained,

a maximum delay that packets in a data connection are allowed to tolerate,

a maximum jitter that a data connection is allowed to tolerate,

minimum reliability that each data connection is to be provided,

an inclusion of network elements capable of acting as security gateways that bracket untrusted sections of the candidate path,

reachability,

a data collection capability to be instantiated between locations when the service is in use,

subscribers who subscribe the service,

parties involved in providing or using the service,

network locations of each party,

a maximum amount of concurrent usage of the service between the network locations,

each data connection to be instantiated between the network locations when the service is in use,

whether data transfer over a data connection is one-way or two-way,

whether security is to be provided and a security profile which determines nature of the security to be provided, and

types of data to be collected regarding packets flowing through the data connection and granularity at which the data is to be collected.

32. (Currently Amended) The machine-readable recording medium storing the instructions of claim 30, further comprising:

reserving a predetermined percentage of bandwidth for each direction of a data link,

wherein reserving the predetermined percentage of bandwidth is to provide room for manually deployed services,

provide a buffer to accommodate unanticipated network traffic, and

provide a buffer to accommodate one of an imprecisely understood behaviour and an imprecise bandwidth control in a router feeding of a data link; and

determining an effective bandwidth capacity of the data link by subtracting the reserved bandwidth from an available associated with the data link.

33. (Currently Amended) The machine-readable recording medium storing the instructions of claim 30, wherein operations further comprise:

assigning to a link in a graph that is not in a preferred area of a network a weight that is different than a weight assigned to a link in the graph that is in a preferred area of the network;

adjusting a weight assigned to a link in the graph depending on a proportion of usage of available bandwidth of the link, wherein a link in the graph having heavier usage relative to other links in the graph is adjusted to a weight indicating a lesser preference, and wherein a link in the graph having lighter usage relative to other links in the graph is adjusted to a weight indicating a greater preference; and

displaying the graph in a display, wherein vertices represent routers and links represent data links, wherein the links in the graph have a directionality indicating a direction in which packets in one embodiment flow on the corresponding data link, and wherein two-way data links are represented in the graph by one of a bi-directional link and two back-to-back uni-directional links directed in opposite directions.

34. (Currently Amended) The machine-readable recording medium storing the instructions of claim 30, wherein if a router is not capable of managing cross-router queuing delay, the minimum bandwidth is determined based on the following:

$BW_{min} = \max(BW_{max}, (S_{max} / D_{max}))$,

wherein BW_{min} represents a minimum bandwidth in bits per second, wherein BW_{max} represents a required maximum bandwidth from the data connection description in bits per second, wherein S_{max} represents a maximum size of a packet in bits, and wherein D_{max} represents a maximum cross router queuing delay in seconds.

35. (Currently Amended) A machine-readable recording medium ~~that provides~~ storing the instructions that, when executed by a machine, cause the machine to perform operations comprising:

identifying a set of one or more candidates paths for a newly requested service in an Internet Protocol (IP) network having a plurality of routers, wherein each of the candidate paths travels through a different subset of the plurality of routers, the newly requested service having a service description;

eliminating a candidate path from the set of candidate paths whose corresponding subset of the plurality of routers cannot be configured to meet the set of requirements specified by the service description including a minimum bandwidth required by the service being deployed, wherein the minimum bandwidth is determined based on $BW_{min} = \max(BW_{max}, (S_{max} / D_{max}))$, wherein BW_{min} represents a minimum bandwidth in bits per second, wherein BW_{max} represents a required maximum bandwidth from the data connection description in bits per second, wherein S_{max} represents a maximum size of a packet in bits, and wherein D_{max} represents a maximum cross router queuing delay in seconds; and

translating a remaining candidate path into a set of router management commands to configure the subset of the plurality of routers.

36. (Currently Amended) The machine-readable recording medium storing the instructions of claim 35, wherein the operations further comprise:

reserving a predetermined percentage of bandwidth for each direction of a data link, wherein reserving the predetermined percentage of bandwidth is to provide room for manually deployed services,

provide room for manually deployed services,

provide a buffer to accommodate unanticipated network traffic, and provide a buffer to accommodate one of an imprecisely understood behaviour and an imprecise bandwidth control in a router feeding of a data links; and

determining an effective bandwidth capacity of the data link by subtracting the reserved bandwidth from an available bandwidth associated with the data link.

37. (Currently Amended) The machine-readable recording medium storing the instructions of claim 35, wherein the operations further comprise:

assigning to a link in a graph representing the network that is not in a preferred area of a network a weight that is different than a weight assigned to a link in the graph that is in a preferred area of the network;

adjusting a weight assigned to a link in the graph depending on a proportion of usage of available bandwidth of the link, wherein a link in the graph having heavier usage relative to other links in the graph is adjusted to a weight indicating a lesser preference, and wherein a link in the graph having lighter usage relative to other links in the graph is adjusted to a weight indicating a greater preference; and

displaying the graph in a display, wherein vertices represent routers and links represent data links, wherein links in the graph have a directionality indicating a direction in which packets in one embodiment flow on the corresponding data link and wherein two-way data links are represented in the graph by one of a bi-directional link and two back-to-back uni-directional links directed in opposite directions.

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joshua Joo who telephone number is 571 272-3966

August 22, 2005
JJ